

**WHAT IS CLAIMED IS:**

1. A method for generating an echo profile in a time-of-flight ranging system, said method comprising the steps of:

transmitting a transmit burst of energy to a reflective surface;  
receiving reflected pulses from said reflective surface, and converting said reflected pulses into echo signals for the echo profile;  
performing recursive descent parsing on said echo profile;  
determining one or more echoes in said echo profile through said recursive descent parsing.

2. The method as claimed in claim 1, wherein said step of performing recursive descent parsing comprises characterizing the echo profile into peaks and valleys, wherein said peaks start or end at a valley.

3. The method as claimed in claim 2, wherein said peaks are further characterized in terms of bumps, and said recursive descent parsing is applied to said bumps, said recursive descent parsing of said bumps comprises recursively processing said bumps to identify bumps which cannot comprise valid echoes in the echo profile.

4. The method as claimed in claim 3, wherein said recursive processing of said bumps comprises identifying bumps as noise in the echo profile and eliminating those identified bumps from further consideration as a potential echo.

5. The method as claimed in claim 2, further comprising the step of partitioning said peaks into corresponding up half peaks and down half peaks, each said up half peaks starting on a corresponding valley, and each of said down half peaks ending on a corresponding valley.

6. The method as claimed in claim 5, wherein said peaks are further characterized in terms of bumps, and said recursive descent parsing is applied to said bumps to identify bumps which cannot comprise valid echoes.

7. The method as claimed in claim 6, wherein said recursive descent parsing of said bumps comprises identifying bumps as noise in the echo profile and parsing those identified bumps from further processing.

8. A method identifying echoes in an echo profile for a time-of-flight ranging system, said method comprising the steps of:

transmitting a transmit burst of energy to a reflective surface;

receiving reflected pulses from said reflective surface, and converting said reflected pulses into potential echoes in the echo profile;

performing recursive descent parsing on the echo profile to identify valid echoes in the echo profile and eliminate invalid echoes from the echo profile.

9. The method as claimed in claim 8, wherein said step of performing recursive descent parsing comprises characterizing the echo profile as comprising a plurality of peaks and a plurality of valleys, each of said peaks beginning at a valley and ending at a valley.

10. The method as claimed in claim 9, wherein said step of characterizing the echo profile as comprising peaks and valleys comprises the steps of:

determining changes of direction in the echo profile;

for each of said changes of direction determining a size for said change of direction in relation to the last change in direction;

recording coordinates for each of said changes in direction;

characterizing each of said changes of direction as a peak or as a valley based on said coordinates and said size.

11. The method as claimed claim 10, further including the step of identifying a maximum peak from said plurality of peaks and the step of identifying a minimum valley from said plurality of valleys.

12. The method as claimed in claim 11 further including the step of setting a start point for parsing on one of the peaks in the echo profile, and the step of setting an end point on another of the peaks in the echo profile.

13. The method as claimed in claim 10, further including the step of partitioning each of said peaks into an up half peak and a down half peak.

14. The method as claimed in claim 13, wherein said peaks are further characterized as bumps, and said recursive descent parsing is applied to said bumps to identify noise in the echo profile and eliminate the associated bumps from further consideration as potential echoes.

15. The method as claimed in claim 13 wherein one of said half peaks corresponds to a ring down section in the echo profile.

16. A level measurement device for measuring a distance to a material having a surface, said level measurement device comprising:

- a transducer for emitting energy pulses and detecting energy pulses reflected by the surface of the material;

- a controller having a receiver and a transmitter;

- said transducer having an input port operatively coupled to said transmitter and being responsive to said transmitter for emitting said energy pulses, and said transducer including an output port operatively coupled to said receiver for outputting reflected energy pulses coupled by the transducer;

- said receiver including a converter for converting said reflected energy pulses into signals

said controller including a program component for generating an echo profile based on said signals, said echo profile comprising potential echoes and potential noise;

said controller including another program component for performing recursive descent parsing on said echo profile and for identifying one or more echoes in said echo profile.

17. The device as claimed in claim 16, wherein said recursive descent parsing component includes a program component for characterizing said echo profile into peaks and valleys.

18. The device as claimed in claim 17, wherein said peaks are further characterized in terms of bumps, said recursive descent parsing component recursively processes said bumps to identify bumps which cannot comprise valid echoes in the echo profile.

19. The device as claimed in claim 18, wherein said recursive descent parsing component includes a program component for partitioning said peaks into corresponding up half peaks and down half peaks, each said up half peaks starting on a corresponding valley, and each of said down half peaks ending on a corresponding valley.

20. The device as claimed in claim 19, wherein one of said half peaks corresponds to a ring down section in the echo profile and said recursive descent parsing component includes a program component for processing potential echoes in said ring down section.

21. A time of flight ranging system comprising:

a transducer for emitting energy pulses and detecting reflected energy pulses;

a controller having a receiver and a transmitter;

said transducer having an input port operatively coupled to said transmitter and being responsive to said transmitter for emitting said energy pulses, and said transducer including an output port operatively coupled to said receiver for outputting reflected energy pulses coupled by the transducer;

said receiver including a converter for converting said reflected energy pulses into electrical signals;

said controller including a program component for generating an echo profile based on said electrical signals, said echo profile comprising potential echoes and potential noise;

said controller including another program component for performing recursive descent parsing on said echo profile and for identifying one or more echoes in said echo profile.